Aviation Spectrum Resources Inc. ♦ 180 Admiral Cochrane Drive ♦ Suite 300 ♦ Annapolis, MD 21401
Phone: 410-266-6030 ♦ Fax: 443-951-0349 ♦ http://www.asri.aero

May 31, 2018

Via Electronic Filing

Marlene H. Dortch
Secretary
Federal Communications Commission
Washington, DC 20554

Re: Expanding Flexible Use of the 3.7 GHz to 4.2 GHz Band
Gen. Docket No. 18-122
Ex Parte Presentation

Dear Ms. Dortch:

Aviation Spectrum Resources Inc. ("ASRI") provides the following comments in response to the Commission's request for "*…filings related to the potential for more intensive use of the 3.7-4.2 GHz Band*."[1] ASRI is the communications company of the US civilian air transport industry and is owned by the airlines and other airspace users. As sponsor of the Aeronautical Frequency Committee ("AFC"), ASRI brings together expertise and opinions from across the aviation sector to promote the safe and effective operation of commercial aviation radio communications and navigation systems in use within the US.[2]

As previously noted in GN Docket No. 17-183, ASRI and other aviation organizations have raised several critical aspects that must be fully considered in any spectrum repurposing in the 3.7-4.2 GHz band, including both co- and adjacent band.[3] These include the radio altimeter, Wireless Avionics Intra-Communications ("WAIC"), and C-band Satellite Communication ("SATCOM"). ASRI, therefore, echoes the aviation community's standing position that changes to existing allocations cannot be considered in isolation when aviation safety services operating under ITU-R Article 4.10 are involved. Accordingly, both in-band and adjacent-band systems should be assessed fully and accounted for by the Commission and the Federal Aviation Administration ("FAA") in any future FCC actions on the 3.7-4.2 GHz band.

C-Band SATCOM

Aviation has been a long-term user of C-band SATCOM as the system provides an exceedingly high level of availability compared to Ku and Ka SATCOM systems. The ability to withstand changing

[1] Public Notice, DA 18-396, rel. 19 August 2018.
[2] AFC membership includes: Airlines for America (A4A), Alaska Airlines, American Airlines, Aircraft Owners and Pilots Association (AOPA), ARINC/Rockwell Collins IMS, Aviation Spectrum Resources, Inc. (ASRI), Boeing Corporation, Bristow Helicopters, Chevron, Delta Airlines, Era Helicopters, Federal Aviation Administration (FAA), Federal Express (FedEx), Frontier Airlines, Harris Corporation, Helicopter Association International (HAI), Helicopter Safety Advisory Conference (HSAC), International Air Transport Association (IATA), JetBlue Airways, National Air Transportation Association (NATA), PHI, Inc., Societe Internationale de Telecommunications Aeronautique (SITA), Southwest Airlines, United Airlines, United Parcel Service (UPS)
[3] *See* Reply Comments of Aviation Spectrum Resources Inc, GN Docket 17-183, dated 3 October 2017

environmental conditions means C-band SATCOM is used worldwide for the backhauling of important aviation data from remote sites or as a redundant secondary link for emergencies should local infrastructure fail. The loss of a radar feed or air traffic control message for several minutes due to a thunderstorm over a control center is not a safe option for aviation to implement. Thus, C-band has become essential when other services cannot meet the required performance or are simply unavailable. In the US these critical uses specifically include the National Oceanic and Atmospheric Administration's ("NOAA") weather distribution system called NOAAPORT, providing weather feeds from NOAA's satellite systems to aviation users.[4] The system was recently upgraded to accommodate NOAA's more advanced Geostationary Operational Environmental Satellite ("GOES-R") imagery.[5]

ASRI urges the Commission to exercise caution in its approach to potentially large changes to the C-band SATCOM allocation, especially with the few alternatives for mission specific data certain industries require. The aviation community is still assessing the plan proposed by Intelsat/SES/Intel on use of the 3.7-3.8 GHz band for 5G services, and is in discussions with their representatives to understand the details of the proposal.

Radio Altimeter and WAIC

The radio altimeter is a core navigational system that provides a continuous report of the aircraft's height above terrain. It operates in the Aeronautical Radio Navigation Service allocation between 4.2-4.4 GHz. Radio altimeters serve important safety functions in landing/take-off, low level maneuvering, and avoiding changes in terrain that may not be visible at night or during bad weather. This technology was widely introduced after a number of aviation incidents up to the 1970's of aircraft flying unintentionally into the ground, a circumstance formally known as Controlled Flight Into Terrain ("CFIT"). The radio altimeter has significantly improved aviation safety for all aircraft types since its introduction, and is now essential for automated landings that increases the safety and efficiency of air travel. Over 55,000 aircraft across the U.S. are now equipped with radio altimeters including large commercial aircraft, helicopters and private aircraft, as well as the many thousands of international aircraft entering US airspace every day. Medium to large aircraft are often fitted with a minimum of two altimeters operating simultaneously for redundancy as part of the Minimum Equipment List ("MEL") given their importance to safety of flight. ASRI has provided additional information to the Commission on this very issue in 2011, noting back then that a full retrofit of just the U.S. fleet would be over $2 billion, let alone the international implications.[6]

A radar-based system, commercial radio altimeter avionics use Frequency Modulated Continuous Wave ("FMCW") or pulses to continually report the distance to the terrain below the aircraft. The system operates in all phases of flight, from operation on the ground to high cruising altitudes, and adapts its operation depending on the reported altitude. Low level flight is the most critical, requiring less than 3 ft of resolution to ensure accurate navigation and landing by either the pilot or autopilot depending on the aircraft approach type. This is achieved by the altimeters increasing the swept or pulsed signal bandwidth to nearly the full 200 MHz allocation, as identified the ITU-R Recommendation M.2059-0 which defines generic performance for a range of in-service altimeters.[7] By defining the generic altimeter performance, the aviation community was able to demonstrate that sharing was possible in the same frequency band with a new wireless avionics network named WAIC. Granted an AM(R)S allocation at WRC-15, WAIC

---

[4] *See* http://www.nws.noaa.gov/noaaport/html/channels.shtml

[5] *See* http://www.nws.noaa.gov/noaaport/html/noaaport_expansion.shtml

[6] *See* Comments of ASRI in the Matter of Spectrum Task Force Requests Information on Frequency Bands Identified by NTIA As Potential Broadband Spectrum, ET Docket No. 10-123, dated 22 April 2011.

[7] *See* Operational and technical characteristics and protection criteria of radio altimeters utilizing the band 4 200-4 400 MHz, ITU-R Recommendation M.2059-0.

achieved compatibility with the altimeters on the same airframe through a combination of low power, antenna directivity, and adaptive channeling mechanisms to avoid the altimeter receivers as it sweeps through the 200 MHz bandwidth. However, the radio altimeter was still deemed by WRC-15 to have priority over WAIC given its role in aviation safety.[8]

Furthermore, since the 2014 ITU-R altimeter recommendation was approved, the aviation industry has been aware of attempts to repurpose parts of the C-band for terrestrial broadband usage worldwide. Preliminary studies have been submitted to the UN's International Civil Aviation Organization ("ICAO") showing an impact from adjacent band terrestrial emissions that would cause interference several miles away from a base station.[9] To ensure greater protection of the altimeter in a changing RF environment, the aviation industry initiated in 2016 its own testing of altimeters to further understand the known RF performance of commercial altimeters. This work is supported by global aerospace manufacturers, international aviation operators, the FAA and ASRI; it is expected to be completed by Q1 2019 to inform worldwide aviation standards through ICAO. Aviation believes this will provide the Commission and other national regulators the necessary information to fully protect all existing radio altimeters whilst ensure efficient use of the C-band spectrum.

Summary

The C-band in, and adjacent to, 3.7-4.2 GHz is extensively used by aviation for SATCOM, navigation and new aviation communications technologies. Many of these systems support functions that are essential to safe and efficient air travel both domestically and internationally. While ASRI supports new technologies such as 5G given the expected use by the aviation industry, a balanced approach must be taken with existing systems. Mid-band spectrum can be a component to the 5G architecture. However, it would make little sense to aggressively cannibalize unique SATCOM spectrum for capacity that can be fulfilled by other bands, especially when large amounts of spectrum are expected in the high GHz range for 5G capacity requirements.

Given the potential threat to aviation safety of life, ASRI strongly recommends that the Commission engage the FAA to inform and assess fully the potential for radio altimeter interference before allowing commercial wireless operations in the 3.7 to 4.2 GHz band. ASRI will continue to work with those parties involved and the aviation industry to develop further the information provided here.

Respectfully submitted,

Aviation Spectrum Resources, Inc.

/s/ Kris Hutchison
Kris E. Hutchison, President

/s/ Andrew Roy
Andrew C. Roy CEng MIET, Director, Engineering Services

[8] *See* ITU-R Radio Regulations, Vol. I, Article 5, Footnote 5.436, published 2016.
[9] *See* ICAO studies to WG-Frequency: Preliminary Study into Radio Altimeter Adjacent Band Compatibility, dated 13 March 2014